US009390414B2

(12) **United States Patent**
Wall et al.

(10) **Patent No.: US 9,390,414 B2**
(45) **Date of Patent: Jul. 12, 2016**

(54) **ONE-CLICK OFFLINE BUYING**

(75) Inventors: **Jonathan Wall**, San Francisco, CA (US); **Rob von Behren**, Berkeley, CA (US); **Raymond Emmett Colline, II**, San Bruno, CA (US)

(73) Assignee: **GOOGLE INC.**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 299 days.

(21) Appl. No.: **13/361,343**

(22) Filed: **Jan. 30, 2012**

(65) **Prior Publication Data**

US 2013/0073448 A1 Mar. 21, 2013

Related U.S. Application Data

(60) Provisional application No. 61/536,042, filed on Sep. 18, 2011.

(51) **Int. Cl.**

G06Q 40/00	(2012.01)
G06Q 20/32	(2012.01)
G06Q 20/36	(2012.01)

(52) **U.S. Cl.**

CPC ***G06Q 20/3278*** (2013.01); ***G06Q 20/367*** (2013.01)

(58) **Field of Classification Search**

CPC G06Q 10/00; G06Q 20/00; G06Q 30/00; G06Q 40/00

USPC 705/3–44

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,005,942	A	12/1999	Chan et al.
6,141,752	A	10/2000	Dancs et al.
6,484,174	B1	11/2002	Wall et al.
6,647,260	B2	11/2003	Dusse et al.
7,072,854	B2	7/2006	Loeser
7,110,792	B2	9/2006	Rosenberg
7,128,274	B2	10/2006	Kelley et al.
7,140,549	B2	11/2006	de Jong
7,152,782	B2	12/2006	Shenker et al.

(Continued)

FOREIGN PATENT DOCUMENTS

CN	101536008	A	9/2009
CN	102836216	A	9/2010

(Continued)

OTHER PUBLICATIONS

ECMA-352 Near Field Communication Interface and Protocol-2 (NFCIP-2) (retrieved from www.ecma-international.org), *ECMA International Standard*, pp. 1-12, Jun. 1, 2010.

(Continued)

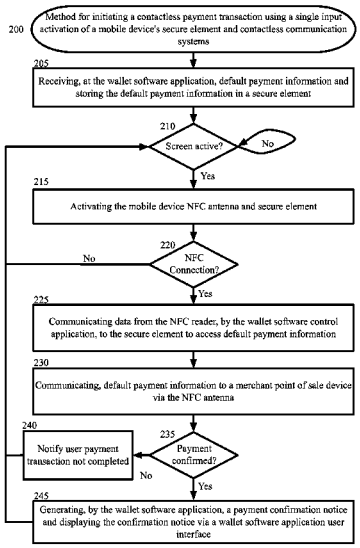
Primary Examiner — Frantzy Poinvil

(74) *Attorney, Agent, or Firm* — Johnson, Marcou & Isaacs, LLC

(57) **ABSTRACT**

Contactless payment transactions are initiated through single input activation of a mobile device's secure element and contactless communication system. Activation of the secure element and the contactless communication system is coupled to the activation status of the mobile device's screen. Activation of the secure element may be further coupled to the activation status of an electronic wallet application. Where activation of the electronic wallet application is required, one-click activation of the electronic wallet application and secure element is provided.

24 Claims, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,232,073	B1	6/2007	de Jong	
7,243,853	B1	7/2007	Levy et al.	
7,255,264	B2	8/2007	De Leon	
7,275,685	B2	10/2007	Gray et al.	
7,374,099	B2	5/2008	de Jong	
7,469,151	B2	12/2008	Khan et al.	
7,494,055	B2	2/2009	Fernandes et al.	
7,631,346	B2	12/2009	Hinton et al.	
7,631,810	B2	12/2009	Liu et al.	
7,748,618	B2	7/2010	Vawter	
7,784,684	B2	8/2010	Labrou et al.	
7,896,233	B2	3/2011	Phillips	
7,949,309	B2	5/2011	Rofougaran et al.	
7,996,320	B2	8/2011	Bishop et al.	
8,005,426	B2	8/2011	Huomo et al.	
8,016,192	B2	9/2011	Messerges et al.	
8,041,338	B2	10/2011	Chen et al.	
8,121,945	B2 *	2/2012	Rackley, III	G06Q 20/042 235/380
8,126,806	B1 *	2/2012	DiMartino et al.	705/41
8,131,596	B2	3/2012	McQuilken	
8,240,560	B2	8/2012	Adams et al.	
8,358,596	B2	1/2013	Byrne et al.	
8,369,889	B2	2/2013	Rofougaran et al.	
8,380,177	B2 *	2/2013	Laracey	G06Q 30/0253 370/259
8,467,766	B2 *	6/2013	Rackley, III	G06Q 20/042 455/406
8,577,810	B1 *	11/2013	Dalit	G06F 21/32 705/1.1
2001/0018666	A1	8/2001	Sugiyama et al.	
2002/0068554	A1	6/2002	Dusse	
2002/0194138	A1	12/2002	Dominguez et al.	
2004/0181453	A1	9/2004	Ray et al.	
2005/0071418	A1	3/2005	Kjellberg et al.	
2005/0222961	A1	10/2005	Staib et al.	
2006/0018450	A1	1/2006	Sandberg-Diment	
2006/0165060	A1	7/2006	Dua	
2007/0099679	A1	5/2007	Saarisalo	
2007/0135164	A1	6/2007	Lee	
2007/0156436	A1	7/2007	Fisher et al.	
2007/0278290	A1	12/2007	Messerges et al.	
2008/0011837	A1	1/2008	Wesley	
2008/0051059	A1	2/2008	Fisher	
2008/0085698	A1	4/2008	Gamm	
2008/0230615	A1	9/2008	Read et al.	
2008/0287060	A1	11/2008	Ramsten et al.	
2008/0306849	A1	12/2008	Johnson, Jr. et al.	
2009/0006263	A1	1/2009	Power et al.	
2009/0068982	A1	3/2009	Chen et al.	
2009/0094125	A1	4/2009	Killian et al.	
2009/0144161	A1	6/2009	Fisher	
2009/0170483	A1	7/2009	Barnett et al.	
2009/0192935	A1	7/2009	Griffin et al.	
2009/0240626	A1	9/2009	Hasson et al.	
2009/0254479	A1 *	10/2009	Pharris	G06Q 20/102 705/42
2010/0023449	A1	1/2010	Skowronek et al.	
2010/0049654	A1	2/2010	Pilo	
2010/0088188	A1	4/2010	Kumar et al.	
2010/0130240	A1	5/2010	Hart	
2010/0161403	A1	6/2010	Fisher et al.	
2010/0174598	A1	7/2010	Khan et al.	
2010/0211504	A1	8/2010	Aabye et al.	
2010/0257033	A1	10/2010	Roberts et al.	
2010/0312629	A1	12/2010	Wolf	
2011/0076941	A1	3/2011	Taveau et al.	
2011/0093326	A1	4/2011	Bous et al.	
2011/0112968	A1	5/2011	Florek et al.	
2011/0171907	A1	7/2011	Jolivet	
2011/0173073	A1	7/2011	Wang et al.	
2011/0177780	A1	7/2011	Sato et al.	
2011/0187652	A1	8/2011	Huibers	
2011/0191438	A1	8/2011	Huibers et al.	
2011/0191823	A1	8/2011	Huibers	
2011/0202415	A1	8/2011	Casares et al.	
2011/0275421	A1	11/2011	Wong et al.	
2011/0292973	A1	12/2011	Kianush et al.	
2011/0320293	A1	12/2011	Khan	
2012/0015605	A1	1/2012	Sole	
2012/0023026	A1	1/2012	Chen et al.	
2012/0078751	A1	3/2012	MacPhail et al.	
2012/0108173	A1	5/2012	Hahm et al.	
2012/0190386	A1 *	7/2012	Anderson	G01C 15/04 455/456.3
2012/0310743	A1 *	12/2012	Johri	G06Q 20/3278 705/14.58
2012/0329407	A1	12/2012	Rousu et al.	
2013/0060959	A1	3/2013	Taveau et al.	
2013/0080238	A1	3/2013	Kelly et al.	
2013/0090064	A1	4/2013	Herron et al.	
2013/0093388	A1	4/2013	Partovi	
2013/0109433	A1	5/2013	Wang et al.	
2013/0246203	A1 *	9/2013	Laracey	G06Q 30/0253 705/21
2013/0297425	A1 *	11/2013	Wallaja	G06Q 20/4014 705/14.64
2014/0310182	A1 *	10/2014	Cummins	G06Q 20/4012 705/71
2015/0186871	A1 *	7/2015	Laracey	G06Q 20/3278 705/41

FOREIGN PATENT DOCUMENTS

EP	2034428	A1	3/2009
KR	10 0121725		11/2009
KR	1020100034688		4/2010
KR	1020110090899		8/2011
WO	WO 01/22374	A1	3/2001
WO	WO 01/52212	A1	7/2001
WO	WO 2004/054125	A1	6/2004
WO	WO 2006/027646	A1	3/2006
WO	WO 2006/111782	A1	10/2006
WO	WO 2008/034937	A1	3/2008
WO	WO 2009/018255	A2	2/2009
WO	WO 2009/036264	A1	3/2009
WO	2010/032216	A1	3/2010
WO	WO 2010/032216	A1	3/2010
WO	WO 2010/144370	A2	12/2010
WO	WO 2011/127627	A1	10/2011

OTHER PUBLICATIONS

Oh, E., International Search Report and Written Opinion for International Patent Application No. PCT/US2012/055951, pp. 1-10, Mar. 15, 2013.

Design and Implementation of Wireless Payment System Using GVM and MobileC, *Proceedings of the International Conference on Mobile Computing and Ubiquitous Networking*, vol. 1, pp. 1-10, 2005.

Mobile Payments at the Physical Point-of-Sale: Assessing U.S. Market Drivers and Industry Direction, *Smart Card Alliance Report*, vol. PT-05001, pp. 1-52, Apr. 2005.

GlobalPlatform: Contactless Services, Card Specification v2.2 Version 1.0, pp. 1-77, Feb. 2010.

PN533 User Manual Rev. 03, *User Manual*, pp. 1-173, Jan. 14, 2009.

Smart Cards; UICC-CLF Interface: Host Controller Interface P2P, LNC Protocol, *European Telecommunications Standards Institute (ETSI)*, vol. 1.0, pp. 1-33, Jan. 11, 2008.

ISO/IEC 21481:2005 Information Technology—Telecommunications and Information Exchange between Systems—Near Field Communication Interface and Protocol-2 (NFCIP-2), *International Standard ISO/IEC*, vol. 21481, pp. 1-5, Jan. 1, 2005.

Boly, J. et al., The ESPIRIT Project CAFE—High Security Digital Payment Systems, *ESCORICS 94 (Third European Symposium on Research in Computer Security)*, pp. 217-230, 1994.

Chen, Z., How to Write a Java Card Applet: A Developer's Guide, JavaWorld.com, pp. 1-9, Jul. 1, 1999.

Corum, C., Editor, Santa Clara Puts Payments in 'Palm' of Your Hand: Palms and Cellphones Initiate Payments to Campus Card System, CR80News.com, vol. 2, pp. 1-5, May 2003.

(56) **References Cited**

OTHER PUBLICATIONS

Daswani, N et al., SWAPEROO: A Simple Wallet Architecture for Payments, Exchanges, Refunds, and Other Operations, *Proceedings of the 3rd USENIX Workshop on Electron Commerce*, pp. 1-20, Aug. 31, 1998.

Dotzer, F., Aspects of Multi-Application Smart Card Management Systems, *Thesis at the Lehrstuhl fur Dateoverarbeitung (LDV)*, pp. 1-124, Oct. 15, 2002.

Hancke et al., Confidence in Smart Token Proximity: Relay Attacks Revisited, *Computers & Secutity*, vol. 28, pp. 615-627, Oct. 1, 2009.

Hernandez, R., E-Wallet Software Architecture and Decentralized Credentials, *Norsk Informatikkonferancse (NIK)*, pp. 1-12, 2003.

Hernandez, R., E-Wallet with Decentralized Credential Keepers, *Master Thesis*, pp. 1-74, Jun. 30, 2003.

Hopping, D., Technology in Retail, *Technology in Society*, vol. 22, pp. 63-74, Jan. 1, 2000.

Huang, P. et al., Future Personal 'E-Payments': IrFM, *IEEE Wireless Communication*, pp. 1-7, Feb. 2006.

Langer, J., NFC-Technologie, *Anwendungen und Technik von Near Field Communication (NFC)*, pp. 87-108, Jan. 1, 2010.

Mjolsnes, S., On-Line E-Wallet with Decentralized Credential Keepers, *Mobile Networks and Applications* , pp. 87-99, 2003.

U.S. Appl. No. 13/246,076, filed Sep. 27, 2011.

U.S. Appl. No. 13/315,818, filed Dec. 9, 2011.

U.S. Appl. No. 13/410,209, filed Mar. 1, 2012.

U.S. Appl. No. 13/443,683, filed Apr. 10, 2012.

U.S. Appl. No. 13/655,321, Wall et al., filed Oct. 18, 2012.

Bolton, H., Australian Office Action issued in Application No. 2011336348, pp. 1-3, May 31, 2013.

Gillmore, A., Australian Office Action issued in Application No. 2012308186, pp. 1-3, Sep. 17, 2013.

Hsieh, P., Office Action issued in copending U.S. Appl. No. 13/443,683, filed Apr. 10, 2012, pp. 1-10, Jul. 5, 2013.

Kang, H. G., International Search Report and Written Opinion issued in Application No. PCT/US2013/035861, pp. 1-12, Jun. 24, 2013.

Shaawat, M., Office Action issued in co-pending U.S. Appl. No. 13/315,818, filed Dec. 9, 2011, pp. 1-8, Jul. 30, 2013.

NFC Forum—Connection Handover Technical Specification, pp. 1-27, Jul. 7, 2010.

Releasing Google Wallet, an Electronic Wallet Using Near Field Communication (NFC) with related English article, URL://http://cusee.net/2462753, pp. 1-10, May 27, 2011.

Bolton, H., Australian Office Action issued in Application No. 2011336348, pp. 1-4, Dec. 19, 2013.

Byrd, U., Office Action issued in copending U.S. Appl. No. 13/410,209, filed Mar. 1, 2012, pp. 1-21, Dec. 5, 2014.

Byrd, U., Office Action issued in copending U.S. Appl. No. 13/410,209, filed Mar. 1, 2012, pp. 1-28, Jun. 19, 2015.

Hardeman, D., Extended European Search Report issued in Application No. 12825391.1, pp. 1-7, Jan. 8, 2015.

Hsieh, P., Officer Acion issued in copending U.S. Appl. No. 14/324,416, filed Jul. 7, 2014, pp. 1-17, Oct. 27, 2014.

Hsieh, P., Final Office Action issued in U.S. Appl. No. 14/324,416, filed Jul. 7, 2014, pp. 1-9, Mar. 3, 2015.

Kai, T., Japanese Office Action issued in Application No. 2013-542212, pp. 1-11, Jul. 4, 2014.

Park, J., Korean Office Action issued in Application No. 10-2014-7009875, pp. 1-8, Jul. 31, 2014.

Park, J., Korean Office Action issued in Korean Application No. 10-2014-700875, pp. 1-7, Mar. 9, 2015.

Rojas, H., Office Action issued in copending U.S. Appl. No. 13/655,321, filed Oct. 18, 2012, pp. 1-13, Dec. 11, 2013.

Shaawat, M., Office Action issued in copending U.S. Appl. No. 13/315,818, filed Dec. 9, 2011, pp. 1-7, Jun. 4, 2014.

Shaawat, M., Office Action issued in copending U.S. Appl. No. 13/315,818, filed Dec. 9, 2011, pp. 1-14, Jan. 17, 2014.

Shaawat, M., Office Action issued in copending U.S. Appl. No. 13/315,818, filed Dec. 9, 2011, pp. 1-8, Aug. 20, 2014.

Wong, C., Canadian Office Action issued in Application No. 2,819,830, pp. 1-6, Nov. 21, 2014.

Yook, S., Korean Office Action issued in Application No. 10-2013-7017123, pp. 1-14, Oct. 7, 2014.

Byrd, U., Office Action issued in copending U.S. Appl. No. 13/410,209, filed Mar. 1, 2012, Jan. 4, 2016.

Zhou, Chinese Office Action issued in Chinese Application No. 201180066157.9 (with English Translation), pp. 1-39, Dec. 28, 2015.

* cited by examiner

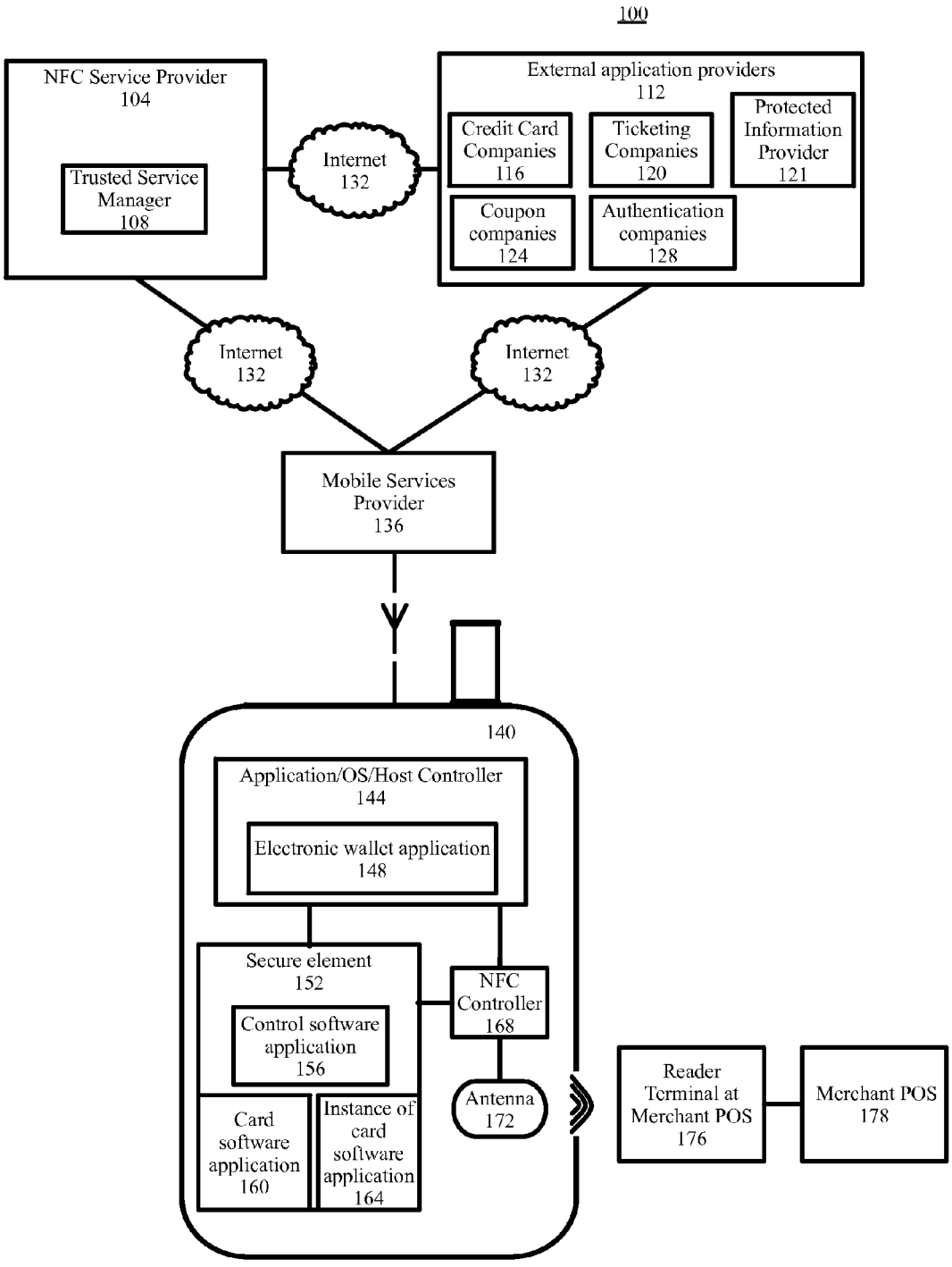

100
NFC Service Provider
104
Trusted Service Manager
108
Internet
132
External application providers
112
Credit Card Companies
116
Ticketing Companies
120
Protected Information Provider
121
Coupon companies
124
Authentication companies
128
Internet
132
Internet
132
Mobile Services Provider
136
140
Application/OS/Host Controller
144
Electronic wallet application
148
Secure element
152
Control software application
156
Card software application
160
Instance of card software application
164
NFC Controller
168
Antenna
172
Reader Terminal at Merchant POS
176
Merchant POS
178

Fig. 1

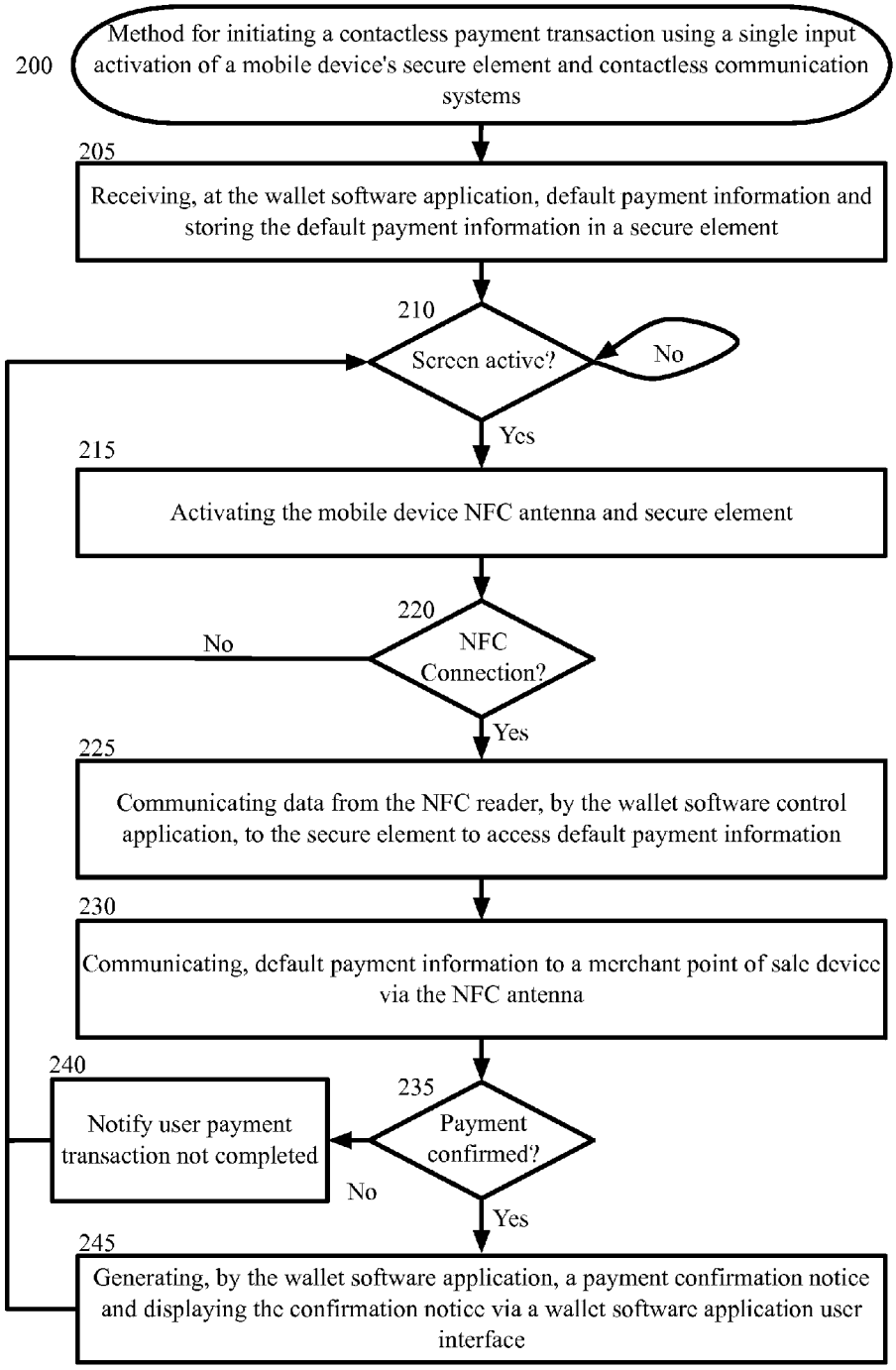

200
Method for initiating a contactless payment transaction using a single input activation of a mobile device's secure element and contactless communication systems
205
Receiving, at the wallet software application, default payment information and storing the default payment information in a secure element
210
Screen active?
No
Yes
215
Activating the mobile device NFC antenna and secure element
220
NFC Connection?
No
Yes
225
Communicating data from the NFC reader, by the wallet software control application, to the secure element to access default payment information
230
Communicating, default payment information to a merchant point of sale device via the NFC antenna
235
Payment confirmed?
No
Yes
240
Notify user payment transaction not completed
245
Generating, by the wallet software application, a payment confirmation notice and displaying the confirmation notice via a wallet software application user interface

Fig. 2

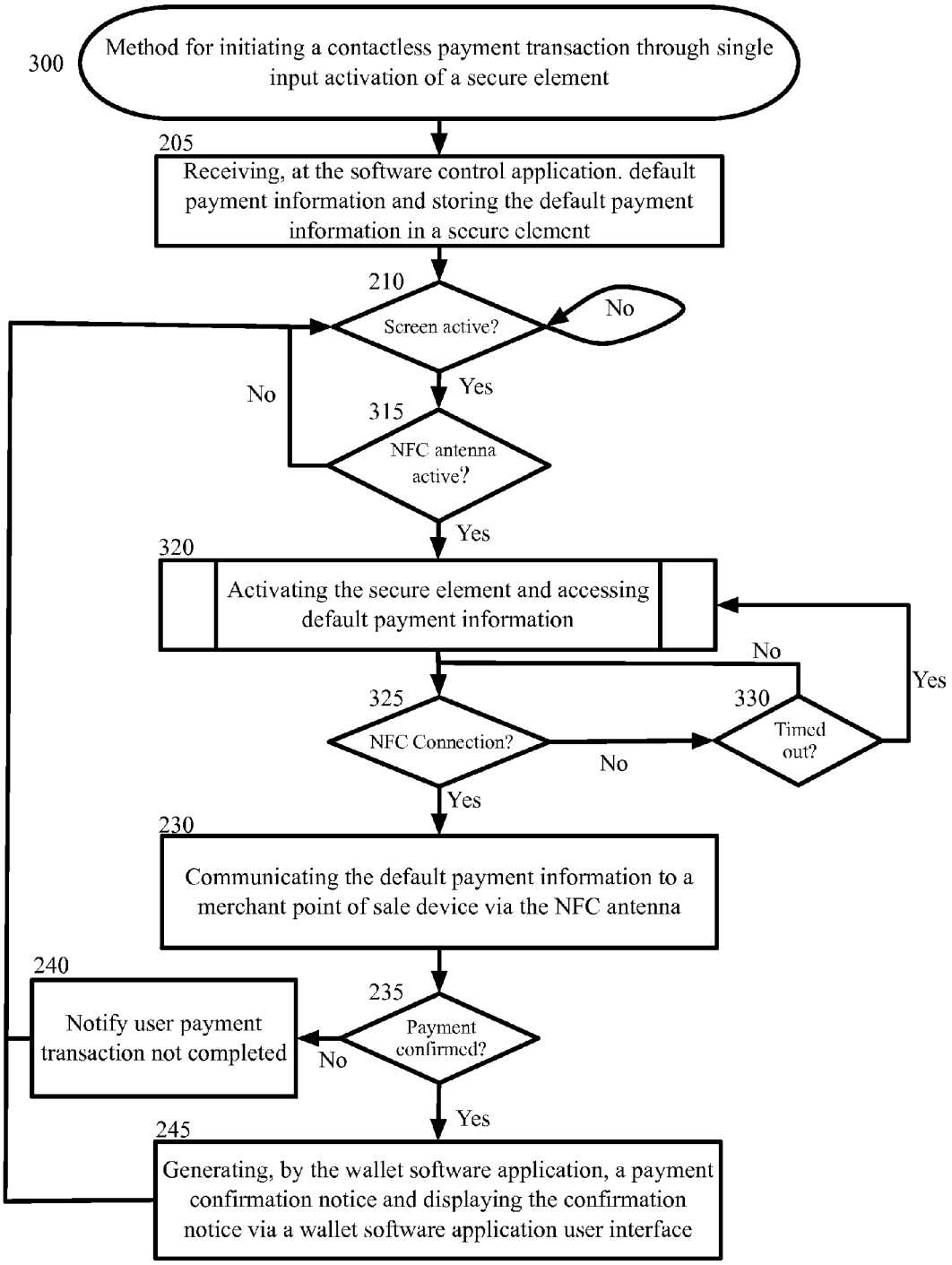

300
Method for initiating a contactless payment transaction through single input activation of a secure element
205
Receiving, at the software control application. default payment information and storing the default payment information in a secure element
210
Screen active?
No
Yes
No
315
NFC antenna active?
Yes
320
Activating the secure element and accessing default payment information
No
Yes
325
NFC Connection?
330
Timed out?
No
Yes
230
Communicating the default payment information to a merchant point of sale device via the NFC antenna
240
Notify user payment transaction not completed
235
Payment confirmed?
No
Yes
245
Generating, by the wallet software application, a payment confirmation notice and displaying the confirmation notice via a wallet software application user interface

Fig. 3

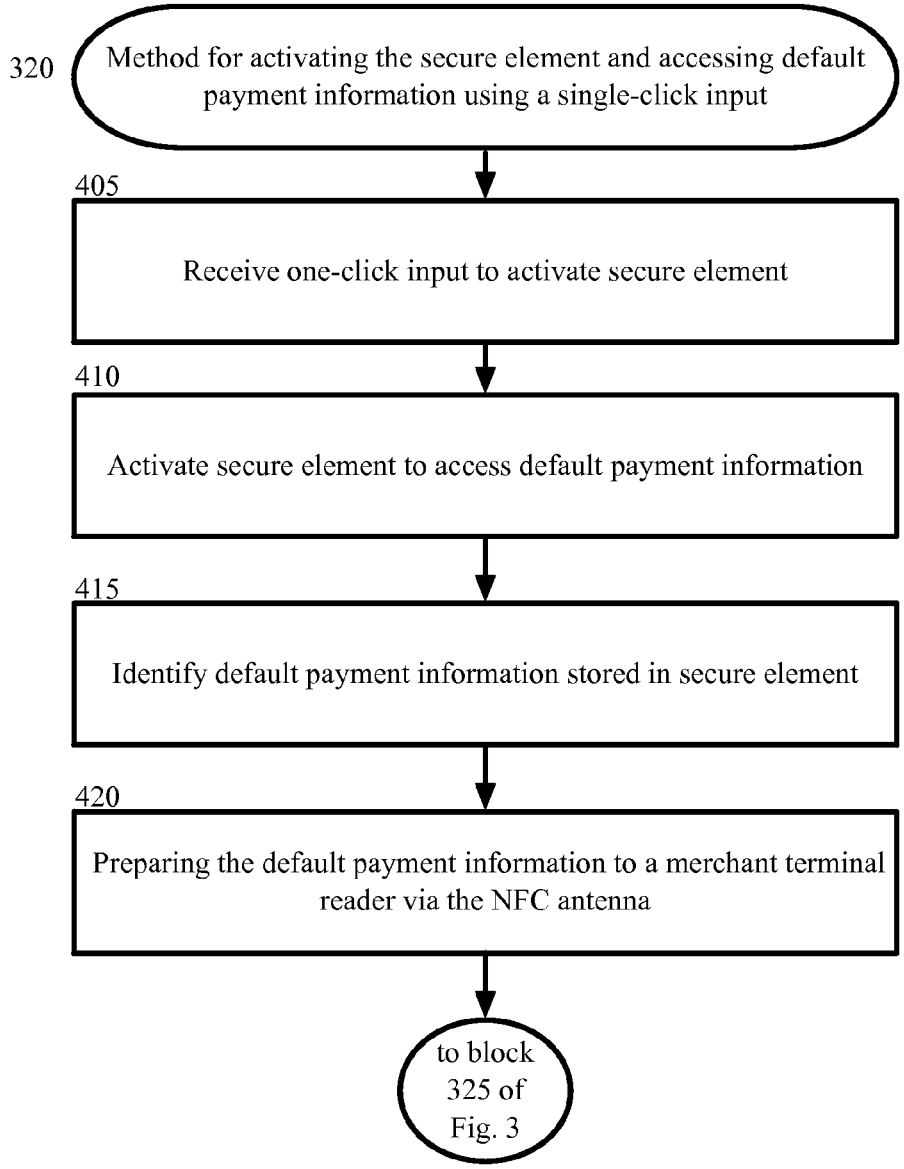

320
Method for activating the secure element and accessing default payment information using a single-click input
405
Receive one-click input to activate secure element
410
Activate secure element to access default payment information
415
Identify default payment information stored in secure element
420
Preparing the default payment information to a merchant terminal reader via the NFC antenna
to block 325 of Fig. 3

Fig. 4

ONE-CLICK OFFLINE BUYING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 61/536,042, entitled "One Click Offline Buying" and filed Sep. 18, 2011. The entire contents of the above-identified priority application are hereby fully incorporated herein by reference.

TECHNICAL FIELD

The invention relates generally to systems, methods, and devices for initiating a contactless payment transaction using a mobile device electronic wallet application, and, more particularly, to systems, methods, and devices whereby a user can use a single action to activate a mobile device secure element that is necessary to initiate a contactless payment transaction.

BACKGROUND

Contactless payment technology incorporates proximity communications between two devices to authenticate and enable payment for goods and services over the air (OTA) or without physical connection. Near Field Communication (NFC) is an example of a proximity communication option that can enable contactless payment technologies and that is supported by the Global System for Mobile Communications (GSM) Association. RFID is an example of a proximity communication method that can be adapted to enable NFC contactless payment technology. NFC communication distances generally range from about 3 to about 4 inches. Such short communication distances enable secure communication between close field proximity enabled devices. Proximity enabled contactless payment also can be implemented on Code Division Multiple Access (CDMA) devices with an embedded secure element within an NFC controller or a Re-usable Identification Module (R-UIM) type card.

Existing contactless payment technology is not integrated with NFC mobile device communication elements. As a result, a user must maneuver through multiple activating steps to initiate a payment transaction. For example, the mobile device must not only be turned "on" but must also be "active." A user must unlock their mobile device and launch a contactless payment application, such as an electronic wallet application. Within the application the user must signal an intent to initiate a payment and enter security information such as a personal identification number. The user must also select a payment option, such as a particular credit card, to use in the payment transaction. The majority of these steps must be repeated for each payment transaction.

Accordingly, there is a need in the art for methods and systems that integrate contactless payment technology with the mobile device's contactless communication systems and streamline the process by which a user can securely initiate payment transactions.

SUMMARY

In certain exemplary embodiments, a computer-implemented method for initiating a contactless payment transaction using a single input activation of a mobile device's secure element comprises detecting the activation status of the mobile device's screen. The contactless communication system of the device is inactive while the device's screen is inactive. An exemplary contactless communication system may comprise an NFC controller and NFC antenna. Upon detection of screen activation, the contactless communication system is activated. In certain exemplary embodiments, the secure element may be also activated upon screen activation. In certain other exemplary embodiments, activation of the secure element may further require an active electronic wallet application. Where activation of the electronic wallet application is required, the electronic wallet application can be activated by a single-click input. The single-click input subsequently activates the secure element, identifies the default payment information, and prepares the default payment information for communication to a merchant reader terminal via the mobile device contactless communication system.

These and other aspects, objects, features, and advantages of the exemplary embodiments will become apparent to those having ordinary skill in the art upon consideration of the following detailed description of illustrated exemplary embodiments, which include the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram depicting systems for processing NFC payment transactions through single action activation of a mobile device secure element in an NFC communication system according to certain exemplary embodiments.

FIG. **2** is a block flow diagram depicting a method for initiating a contactless payment transaction using a single input activation of a secure element in an NFC communication system according to certain exemplary embodiments.

FIG. **3** is a block flow diagram depicting a method for initiating a contactless payment transaction through a single input activation of a secure element independent of NFC communication system activation according to certain exemplary embodiments.

FIG. **4** is a block flow diagram depicting a method for activating a secure element in communication with an electronic wallet application using a single-click input according to certain exemplary embodiments.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Overview

The methods, systems and devices described herein enable a user to initiate a contactless payment transaction through a single input activation of an electronic wallet application. The present invention integrates secure element activation of a contactless payment system with the contactless communication systems of a mobile device, such as an NFC controller and antenna, to allow secure and efficient initiation of contactless payment transactions. Default payment information is specified and stored within a secure element of the mobile device. Upon activation of the mobile device screen from a sleep or powered-down state, or in combination with one-click activation of the electronic wallet application, the secure element and contactless communication systems of the device are activated. Following secure element and contactless communication system activation, the device is prepared to communicate payment information stored in the secure element to a reader terminal connected to a merchant point of sale device. In certain exemplary embodiments, the wallet application remains active even after the mobile device goes dormant. In certain other exemplary embodiments, a user may configure how long the electronic wallet application

remains active before timing out. By maintaining either the contactless communication system, or secure element, or both as inactive, the present invention maintains security and prevents the initiation of payment transactions or access to payment information without the user's consent. By integrating the activation of the mobile device's contactless communication systems and secure elements, the present invention can provide that when the user is ready to initiate a payment transaction, the user can do so efficiently.

One or more aspects of the invention may comprise a computer program that embodies the functions described and illustrated herein, wherein the computer program is implemented in a computer system that comprises instructions stored in a machine-readable medium and a processor that executes the instructions. However, it should be apparent that there could be many different ways of implementing the invention in computer programming, and the invention should not be construed as limited to any one set of computer program instructions. Further, a skilled programmer would be able to write such a computer program to implement an embodiment of the disclosed invention based on the appended flow charts and associated description in the application text. Therefore, disclosure of a particular set of program code instructions is not considered necessary for an adequate understanding of how to make and use the invention. Further, those skilled in the art will appreciate that one or more aspects of the invention described herein may be performed by hardware, software, or a combination thereof, as may be embodied in one or more computing systems. Moreover, any reference to an act being performed by a computer should not be construed as being performed by a single computer as the act may be performed by more than one computer. The inventive functionality of the invention will be explained in more detail in the following description, read in conjunction with the figures illustrating the program flow.

Turning now to the drawings, in which like numerals indicate like (but not necessarily identical) elements throughout the figures, exemplary embodiments are described in detail.

System Architecture

FIG. **1** is a block diagram depicting a system **100** for enabling single input activation of a mobile device secure element to process NFC payment transactions.

An external trusted service manager (TSM) **108** controlled by a near field communications (NFC) service provider **104** hosts and transmits card software applications for installation within the secure element **152** of a contactless smart card in mobile device **140**. The NFC service provider **104** provides a secure key encrypted software card application for decryption and installation in the secure element **152**. The TSM **108** includes a trusted service agent, which may be an automated software distribution entity within the TSM. In certain exemplary embodiments, the TSM may be accessible to the mobile device **140** via the Internet **132** directly, without the requirement of a mobile services provider **136** for the purpose of downloading trusted card software applications to the mobile device. The mobile services provider **136** provides card software applications in one of many mobile services protocol, such as 3G and 4G. In certain exemplary embodiments, the TSM **108** may exist as a part of the mobile services provider **136**.

In certain exemplary embodiments, external application providers **112** provide card software applications to the TSM **108** for deployment to the mobile device **140**. In an alternative embodiment, each of the external application providers **112** may include a TSM for providing trusted card software applications directly to the mobile device via the Internet **132** or the mobile service provider **136**. Exemplary external application providers **112** include credit card companies **116** for providing credit card type payment card software applications, such as Java credit/debit/PayWave/PayPass type applets, ticketing companies **120** for providing tickets to events, travel, and other related functions, coupon companies **124** for providing coupons that are downloaded and scan-able at a point-of-sale (POS) using the contactless smart card, RFID tags, barcodes, QR 2 dimensional bar codes, and other similar optical coding methods, an authentication company **128** for providing authentication data that may be used to lock/unlock physical appliances or for virtual functions on computer software, and a protected information provider **121**, such as a bank, merchant, or other financial service provider, for providing confidential or otherwise protected information (for example, account information), which may be used to instantiate a particular card.

In certain exemplary embodiments, an application host OS **144** on the mobile device **140** provides the user of the mobile device with the capability to manage multiple card software application instances **160-164** using a wallet software application **148**, where the wallet software application does not need TSM **108** permission to perform certain functions on each of the card software application instances **160-164**. The management of the card software applications may be performed via a control software application **156**, which communicates with the wallet software application **148** using APDUs, transmitted and received, through a secure and encrypted communication channel. The control software application **156** may freely communicate with the multiple card software application instances **160-164** because each of the card instances **160-164** and the control software application **156** are resident within the same secure element **152**. Alternatively, multiple secure elements providing secure communication channels can provide the same functionality as disclosed herein. The user may engage the control software application **156** using commands to activate, deactivate, prioritize, delete, and install card software applications **160-164** within the secure element.

When the default card software application has been activated according to the methods of the present invention, the NFC controller **168** is notified of the state of readiness of the mobile device **140** for an NFC transaction. The NFC controller polls, through the antenna **172**, a radio signal, or listens for radio signals from a reader terminal device **176**. On establishing a channel between the devices **172** and **176**, the reader requests to see the list of available card software applications within the secure element **156**. Default payment information is then transmitted from the application **160-164** set as the default payment option to the reader terminal and the transaction is initiated.

System Process

FIG. **2** is a block flow diagram depicting a method **200** for using a single input activation of a mobile device screen to activate a secure element and NFC antenna to process a contactless payment transaction. The method **200** is described with reference to the components illustrated in FIG. **1**.

At block **205**, the electronic wallet application **148** receives input of default payment information from a user of the mobile device via a user interface generated by the electronic wallet application **148**, and communicates the input to the control software application **156** on the secure element **152**. The control software application **156** prioritizes the card software applications **160-164** according to the input received from the electronic wallet application **148**. Alternatively, default payment information may be communicated to the device via the Internet **132**, mobile services provider **136**, or other suitable communication network.

In an exemplary embodiment, the wallet application **148** can operate continuously after being activated.

At block **210**, the method **200** determines whether the screen of the device **140** is active. In this embodiment, the secure element **152** is inactive if the mobile device screen is inactive. In an inactive state, the secure element **152** can neither receive nor communicate payment information through the mobile device contactless communication system, such as the NFC controller **168** and antenna **172**. Upon screen activation, the host controller **144** detects a change in the screen activation status and communicates the change in screen status to the control software application **156** of the secure element **152** and the NFC controller **168**. In an exemplary embodiment, the host controller **144** communicates the screen activation status to the wallet application **148**, which communicates the screen activation status to the control software application **156** of the secure element **152**.

A mobile device screen is "active" or "activated" when powered on and displaying a default home user interface. A screen may become active, for example, by response to direct user input, from the detection of movements that would indicate the user is preparing to use the device, or from the detection of voice commands.

If the screen is active, the method **200** proceeds to block **215**.

At block **215**, the secure element **152** and the NFC controller **168** receive the communication indicating a change in the mobile device screen's activation status. The NFC controller **168** is configured so that the antenna **172** is inactive when the screen is inactive. Accordingly, the antenna **172** will become active and inactive in sync with subsequent communications to the NFC controller **168** indicating the mobile device screen's activation status.

The secure element **152** can neither receive nor transmit data until activated. In an exemplary embodiment, the wallet application **148** can operate continuously after being activated by the user, even when the screen is not active. In this state, the wallet application **148** remains active in the background, awaiting the screen activation status. After receiving the screen activation status from the host controller **144**, the wallet application **148** can activate the secure element **152** for an NFC payment transaction. Accordingly, the secure element **152** will become active and inactive in sync with subsequent communications indicating the mobile device screen's activation status.

At block **220**, the NFC controller **168** polls, through the antenna **172**, a radio signal, or listens for radio signals from a point of sale reader terminal device **176**. If a radio signal is not detected, the method **200** returns to block **210** and continues to monitor. If the screen remains active, there is no change in status communicated to the NFC controller **168** or the secure element **152** at block **215**. Once the screen goes inactive, the change in screen status is communicated to the NFC controller **168** and the secure element **152** following the same procedure discussed in block **215**, and the antenna **172** and the secure element **152** are deactivated.

Referring back to step **220**, while active, if the antenna **172** detects a reader terminal communication field, the method proceeds to block **225**.

At block **225**, data received from the reader terminal **176** at the antenna **172** is communicated to the control software application **156**. The control software application **156** accesses the default payment information stored on the secure element **152** and prepares the payment information for communication to the reader terminal **176**. Multiple forms of payment information can be stored in the secure element **152**. The control software application **156** will select the payment information identified in block **205** as the default payment information for processing the transaction. The user can change or modify the default payment information at their discretion using the electronic wallet application **148**.

At block **230**, the control software application **156** communicates the default payment information to the reader terminal **176** via the NFC antenna **172**. The default payment information is received at the reader terminal **176** and further processed by the merchant POS device **178**.

At block **235** the mobile device **140** waits to receive payment confirmation via the terminal reader **176** from the merchant POS device **178**. The payment confirmation may be monitored by the secure element **152**. Upon receipt of payment confirmation from the merchant POS **178**, the secure element **152** communicates the payment confirmation to the electronic wallet application **148**. The electronic wallet application **148** then notifies the user of the payment confirmation via the user interface generated by the wallet application (see block **245**).

Alternatively, the payment confirmation may be monitored directly by the electronic wallet application **148**. The control software application **156** can notify the electronic wallet application **148** of the communication of payment information to the merchant POS **178**, prompting the electronic wallet application **148** to monitor for receipt of the payment confirmation from the merchant POS **178**.

If the payment is not confirmed at block **235**, the method proceeds to block **240**. At block **240**, the wallet application **148** generates a notification indicating the payment transaction was not completed and communicates the notice to the user via the user interface generated by the electronic wallet application **148**. In certain exemplary embodiments, the electronic wallet application **148** may present to the user the option of selecting an existing account or entering new payment account information to use as the default payment information. The process then returns to block **210** to repeat the method **200** as necessary.

Referring back to block **235**, if the payment is confirmed, the method **200** proceeds to block **245**. At block **245**, the electronic wallet application **148** generates a payment confirmation notice and communicates the notice to the user via the user interface generated by the wallet application **148**. A payment notification may include transaction details such as the details included on standard paper receipts. In an exemplary embodiment, the payment notification may be a replication of a receipt or receipt information received from the merchant POS system **178**.

The payment notifications may be stored by the wallet software application **148** on the mobile device **140**, and/or communicated to a separate device, such as a personal cloud server or other central server or a personal computer of the user. For example, the user may review receipt information via the user interface generated by the wallet application **148**, and/or receipt information may be used by another system to identify user preferences.

From block **245**, the method **200** returns to block **210** to determine whether the screen is still active. If the screen is inactive, the NFC antenna **172** is deactivated by the NFC controller **168**. If the screen is still active, the NFC antenna **172** remains active and ready to detect additional reader terminal **176** radio signals and to initiate subsequent payment transactions.

FIG. **3** is a block flow diagram depicting a method **300** for using a one-click input to activate a secure element **152** to process a payment transaction where activation of the secure element is independent of NFC communication system acti-

vation. The method **300** is described with reference to the components illustrated in FIG. **1**.

In certain exemplary embodiments, the NFC antenna **172** is activated prior to activation of the secure element **152**.

The first two blocks of method **300** proceed as described previously with reference to blocks **205** and **210** of FIG. **2**.

At block **315**, the NFC controller **168** receives the communication indicating a change in the screen activation status and changes the activation status of the antenna **172** accordingly. The NFC controller **168** is configured so that the antenna **172** is inactive when the screen is inactive. Accordingly, the antenna **172** will become active and inactive in sync with subsequent communications to the NFC controller **168** indicating the mobile device screen's activation status.

At block **320**, the secure element **152** is activated and the default payment information is configured for a contactless payment transaction via a single click command. Block **320** will be described in further detail hereinafter with reference to FIG. **4**.

FIG. **4** is a block flow diagram depicting the method **320** for activating, using a one-click input, the secure element **152** to access the default payment information for a contactless payment transaction. Thus, FIG. **4** describes the process **320** by which a one-click input is utilized to activate the secure element **152** to allow processing of an NFC payment transaction according to an exemplary embodiment.

At block **405**, the electronic wallet application **148** receives a one-click input and communicates the input to the secure element **152**. In certain exemplary embodiments, the one-click input comprises a physical tap, a voice command, selection by the user of a defined control on the user interface generated by the electronic wallet application **148**, activation of a defined button on the contactless device **140**, activated of a motion gesture that is detected by a gyroscope or other motion-detecting mechanism of the contactless device **140** (for example, a shake, double shake, "fishing," or other motion of the contactless device **140**). The wallet application **148** detects the user input of the command to ready the secure element **152** for a contactless payment transaction and communicates the command to the secure element **152**.

At block **410**, the control software application **156** of the secure element **152** receives the one-click input communication from the electronic wallet application **148** and activates the secure element **152** to make the default payment information accessible. In this case, activation means that the secure element **152** is able to communicate with a reader terminal for a contactless payment transaction.

At block **415**, the control software application **156** identifies the default payment information stored in the secure element **152**. Multiple forms of payment information can be stored in the secure element **152**. The control software application **156** will select the payment information identified in block **205** of FIG. **3** as the default payment information for processing the transaction. The user can change or modify the default payment information at their discretion using the electronic wallet application **148**.

At block **420**, the control software application **156** prepares the default payment information for communication to the NFC antenna **172**. Preparation of the default payment information can comprise the identification of the default payment information that can be communicated in the payment transaction. Alternatively or additionally, preparation of the default payment information can include encrypting the payment information for secure transmission to a reader terminal. The control software communication module **156** will not communicate the payment information to the NFC antenna **172** until the NFC controller **168** indicates the NFC antenna **172** has detected a reader terminal **176** radio signal.

The method **320** then proceeds to block **325** of FIG. **3**.

Returning to FIG. **3**, at block **325**, the NFC controller **168** polls, through the antenna **172**, a radio signal, or listens for radio signals from a reader terminal device **176**. If no radio signal is detected, the method **300** proceeds to block **330** to determine if an time-out period for activation of the secure element has expired. In certain exemplary embodiments, the time-out period could be based on a time-out period for the wallet application **148**. In certain exemplary embodiments, when the electronic wallet application times-out period expires, a personal identification number, password, or other authentication must be entered to unlock the application. The electronic wallet application time-out period can be configured through settings of the electronic wallet application **148**. If the time-out period has not expired, the NFC controller **168** will maintain the NFC antenna **172** in an active state. If no reader terminal **176** radio signal is detected within the time-out period, the method **300** returns to block **320** and reactivation of the secure element **152** is required.

Referring back to block **325**, if a radio signal is detected at block **325**, the subsequent steps of communicating the default payment information to a merchant point of sale device via the NFC antenna **172**, confirming payment, notifying user payment transaction is complete or not complete, and generating a payment confirmation and displaying the confirmation via the wallet software application **148** interface, proceeds as described previously with reference to blocks **230-245** of FIG. **2**, respectively.

The wallet application **146** in conjunction with the secure element **152** can accommodate multiple payment methods. Within the secure element **152**, multiple credit cards, debit cards, and/or other forms of secure payment can be stored. The user can select a particular one of the payment forms as the default payment method. Additionally, the wallet application **148** can store and process unsecure payment forms, such as coupons, loyalty cards, check-ins, membership cards, gift cards, and other forms of value-added services. The wallet application **148** can communicate these payment forms to the reader terminal **176** via the antenna **172** for application during the payment transaction.

In exemplary embodiments, a payment transaction can comprise one or more payment or other value transactions, all conducted within a single tap of the contactless payment device **140** with the reader terminal **176**.

Exemplary value added services can be embodied in one or more value added applications residing on the device **140** and/or within the secure element **126**. Value added applications can perform functionality to redeem the value added services.

For example, a value added coupon application can automatically redeem coupons stored in the value added coupon application. More specifically, a user may save one or more coupons (or other "offers") to the value added service coupon application on the contactless device **140**. When the default payment information communication is performed in block **230**, the value added coupon can be applied to the transaction. For example, the value added coupon application can search stored coupons that can be applied to the current transaction. This determination can be based on an identity of the merchant operating the POS system **178** and products being purchased, as provided by the device reader **176** to the device **140**. Alternatively, or additionally, merchant information can be determined by the value added coupon application based on geocode information available to the device **140** by comparing the geocode information for the current location of the

device **140** with known merchant locations. After identifying coupons that can apply to the merchant or products, the value added coupon application communicates the coupon(s) to the device reader **176** via the antenna **172**. Thereafter, the POS system **178** processes the coupon for the transaction. If multiple coupons apply to the transaction, the value added service application can determine which coupon offers the greatest value and/or which combination of coupons offers the greatest value and can automatically apply the greatest value choice.

As another example, a value added loyalty application can automatically collect and redeem loyalty rewards. More specifically, a user may install a loyalty application for a particular merchant (or a loyalty application that operates for multiple merchants). Each time a transaction is conducted with the merchant, the value added loyalty application collects loyalty rewards (for example, points, number of visits, number of items purchased, or other suitable reward). Then, when sufficient loyalty rewards have been collected to redeem for value, the value added loyalty application can automatically apply the redemption. For example, when default payment information communication is performed in block **230**, the value added loyalty rewards can be accumulated and/or applied to the transaction. For example, the value added loyalty application can search accumulated rewards that can be applied to the current transaction. This determination can be based on an identity of the merchant and products being purchased, as provided by the device reader **176** to the device **140**. Alternatively, or additionally, merchant information can be determined by the value added loyalty application based on geocode information available to the contactless device **140** by comparing the geocode information for the current location of the device **140** with known merchant locations. After identifying loyalty rewards that can be redeemed for the merchant or products, the value added loyalty application communicates the loyalty reward(s) to the device reader **176** via the antenna **172**. Thereafter, the POS system **178** processes the loyalty rewards for the transaction. If loyalty rewards are not available for redemption, the value added loyalty application communicates a request to accumulate loyalty rewards to the device reader **176** via the antenna **172**. Thereafter, the POS system **178** processes the transaction and communicates the loyalty rewards for the transaction from the device reader **176** to the contactless device **140**. The value added loyalty application increments the stored loyalty rewards accordingly for future redemption.

Other value added applications can be implemented in a similar manner, for example, check-ins, membership cards, gift cards, and other forms of value-added services. Corresponding value added service applications can function to determine whether the particular service applies to the transaction (for example, to the merchant or the product) and to apply the service to the transaction if appropriate. For instance, a gift card having value stored thereon can be applied to the transaction.

In this manner, multiple value added services can be applied in blocks **230** and **235**. The wallet application **148** can process each available value added service application to thereby apply all available value added services to the transaction. Additionally, if multiple value added services apply to the transaction, the application **148** can determine which service offers the greatest value and/or which combination of services offers the greatest value and can automatically apply the greatest value choice. Furthermore, after application of all value added services, the POS system **178** charges the remaining balance to the default payment method through a secure payment transaction with the secure element **152**. All of the transactions can be processed via a single tap of the device **140** to the reader terminal **176**.

The payment confirmation generated in block **245** can identify all items applied to the transaction. For example, the payment confirmation can identify each coupon, loyalty redemption, stored value card, other value added service, and all secure payment forms applied to the transaction, and may also show items included in the transaction (for example, ticket numbers for tickets purchased). In an exemplary embodiment, a single payment confirmation may show all items applied to the transaction. Alternatively, multiple payment confirmations may be provided, wherein each receipt is for a particular one of the items applied to the transaction.

General

The exemplary systems, methods, and blocks described in the embodiments presented previously are illustrative, and, in alternative embodiments, certain blocks can be performed in a different order, in parallel with one another, omitted entirely, and/or combined between different exemplary methods, and/or certain additional blocks can be performed, without departing from the scope and spirit of the invention. Accordingly, such alternative embodiments are included in the invention described herein.

The invention can be used with computer hardware and software that performs the methods and processing functions described herein. As will be appreciated by those having ordinary skill in the art, the systems, methods, and procedures described herein can be embodied in a programmable computer, computer executable software, or digital circuitry. The software can be stored on computer readable media. For example, computer readable media can include a floppy disk, RAM, ROM, hard disk, removable media, flash memory, memory stick, optical media, magneto-optical media, CD-ROM, etc. Digital circuitry can include integrated circuits, gate arrays, building block logic, field programmable gate arrays ("FPGA"), etc.

Although specific embodiments have been described above in detail, the description is merely for purposes of illustration. It should be appreciated, therefore, that many aspects described above are not intended as required or essential elements unless explicitly stated otherwise. Various modifications of, and equivalent acts corresponding to, the disclosed aspects of the exemplary embodiments, in addition to those described above, can be made by a person of ordinary skill in the art, having the benefit of the present disclosure, without departing from the spirit and scope of the invention defined in the following claims, the scope of which is to be accorded the broadest interpretation so as to encompass such modifications and equivalent structures.

What is claimed is:

1. A computer-implemented method to initiate mobile computing device contactless payment transactions, comprising:

detecting, by a programmed mobile computing device, whether a screen activation status of the programmed mobile computing device is active or inactive;

in response to detecting that the screen activation status is inactive, maintaining a contactless communication system of the programmed mobile computing device and a secure element of the programmed mobile computing device in an inactive state, wherein an antenna of the contactless communication system and the secure element cannot receive or transmit data until activated;

in response to detecting that the screen activation status is active, activating, by the programmed mobile computing device, the contactless communication system of the programmed mobile computing device and the secure

element of the programmed mobile computing device, wherein the antenna of the contactless communication system and the secure element can receive or transmit data when activated;

detecting, by the programmed mobile computing device, a contactless communication reader terminal signal;

establishing, by the programmed mobile computing device, a contactless communication session with the reader terminal in response to detecting the reader terminal signal;

receiving, by the programmed mobile computing device, information to conduct a payment transaction from the reader terminal; and

communicating, by the programmed contactless communication system of the mobile computing device, default payment information stored in the secure element of the mobile computing device to the reader terminal in response to receiving the information to conduct the payment transaction.

2. The method of claim **1**, wherein the contactless communication system of the programmed mobile computing device comprises a near field communication (NFC) controller and antenna.

3. The method of claim **1**, wherein the screen activation status of the programmed mobile computing device is active when powered on and displaying a default home user interface.

4. The method of claim **1**, wherein detecting a screen activation status comprises detecting at least one of a direct user input, a movement indicating a user is preparing to use the device, and a voice command.

5. The method of claim **1**, wherein detecting the reader terminal signal comprises one of actively or passively detecting the reader terminal radio signal.

6. The method of claim **1**, wherein communicating the default payment information is controlled by a control software application module of the secure element.

7. The method of claim **1**, wherein activating the secure element comprises:

receiving, by the mobile computing device, a one-click input, and in response to receiving the one-click input:

identifying, by the secure element of the mobile computing device, the default payment information stored in the secure element; and

preparing, by the secure element of the mobile computing device, the default payment information for communication to the reader terminal.

8. A computer-implemented method for initiating mobile computing device contactless payment transactions, comprising:

detecting, by a programmed mobile computing device, whether a screen activation status of the mobile computing device is active or inactive;

in response to detecting that the screen activation status is active, activating, by the programmed mobile computing device, a contactless communication system of the mobile device, wherein an antenna of the contactless communication system cannot receive or transmit data until activated;

in response to activating the contactless communication system, activating, by the programmed mobile computing device, a secure element of the mobile computing device, wherein default payment information is stored in the secure element, and wherein the secure element cannot transmit or receive data until activated;

detecting, by the contactless communication system of the programmed mobile computing device, a signal from a reader terminal; and

communicating, by the contactless communication system of the programmed mobile computing device, the default payment information stored in the secure element of the mobile computing device to the reader terminal in response to detecting the reader terminal signal.

9. The method of claim **8**, wherein activating the secure element comprises:

receiving, by the programmed mobile computing device, a one-click input;

activating, by the programmed mobile computing device, the secure element to thereby provide access to default payment information stored in the secure element;

identifying, by the programmed mobile computing device, the default payment information stored in the secure element; and

preparing, by the programmed mobile computing device, the default payment information for communication to the reader terminal.

10. The method of claim **9**, wherein the one-click input comprises a physical tap, a voice command, selection of a user interface control, selection of a control of the mobile computing device, or a movement gesture of the programmed mobile computing device.

11. The method of claim **9**, wherein identifying and preparing the default payment information is controlled by a control software application module of the secure element.

12. The method of claim **8**, wherein the contactless communication system comprises a near field communication (NFC) controller and antenna.

13. The method of claim **8**, wherein the screen activation status of the programmed mobile computing device is active when powered on and displaying a default home user interface.

14. The method of claim **8**, wherein detecting a screen activation status comprises detecting at least one of a direct user input, a movement indicating a user is preparing to use the device, and a voice command.

15. The method of claim **8**, wherein detecting the reader terminal radio signal comprises one of actively or passively detecting the reader terminal radio signal.

16. A computer program product, comprising:

a non-transitory computer readable medium having computer-readable program code embodied thereon that when executed by a mobile computing device causes the mobile computing device to activate a secure element of the mobile computing device, the computer-readable medium comprising:

computer-readable program code to detect whether a screen activation status of the mobile computing device is active or inactive;

computer-readable program code to activate a contactless communication system and a secure element of a the mobile computing device in response to detecting that the screen activation status is active, wherein an NFC antenna of the contactless communication system and the secure element cannot receive or transmit data until activated;

computer-readable program code for receiving a one-click input, wherein the one-click input initiates a contactless payment transaction using default payment information stored in the secure element of the mobile computing device;

computer-readable program code for communicating the one-click input to the secure element, wherein

receipt of the communication by a control software application of the secure element activates the secure element;

computer-readable program code for identifying the default payment information stored in the secure element; and

computer-readable program code for preparing the default payment information for communication by the mobile computing device to a terminal reader.

17. The computer program product of claim **16**, further comprising computer-readable program code for communicating the default payment information from the secure element to a contactless communication system of the mobile computing device.

18. The computer program product of claim **17**, wherein the contactless communication system of the mobile computing device comprises a near field communication (NFC) controller and antenna.

19. The computer program product of claim **16**, wherein the one-click input is a physical tap, a voice command, selection of a user interface control, selection of a control of the mobile computing device, or a movement gesture of the mobile computing device.

20. The computer program product of claim **16**, wherein the secure element comprises the control software application and at least one card software application, wherein the default payment information is stored in the at least one card software application, and wherein the control software application identifies the default payment information in the at least one card software application.

21. A mobile computing device for processing mobile device contactless payment transactions, comprising:

a contactless communication device comprising an antenna, wherein the antenna cannot receive or transmit data when inactive;

a storage device comprising a secure element, wherein the secure element cannot transmit or receive data when inactive; and

a processor communicatively coupled to the contactless communication device and the storage device, wherein the processor executes application code instructions that cause the mobile computing device to:

detect a screen activation status of a screen of the mobile computing device;

activate the contactless communication device when the screen activation status is detected as being active;

activate the secure element when the screen activation status is detected as being active;

detect a contactless communication signal of a reader terminal;

access default payment information stored in the secure element in response to detecting the contactless communication of the reader terminal; and

communicate, via the contactless communication system, the default payment information to the reader terminal.

22. The system of claim **21**, wherein activating the secure element comprises receiving a one-click electronic wallet application input.

23. The system of claim **21**, wherein the contactless communication system comprises a near field communication (NFC) controller and antenna.

24. The system of claim **21**, wherein detecting the reader terminal signal comprises actively or passively detecting the reader terminal radio signal.

* * * * *